

the substrate processing zone to form a desired film on a deposition substrate by gas phase chemical reaction between the first gas containing neutral radicals and the second gas and a hole through which the first gas containing the neutral radicals is uniformly supplied to the substrate processing zone; and

the gas introducing member has a hollow structure, accommodates dispersing plates within the hollow structure for uniformizing the second gas in the gas introducing member and the hole for introducing the second gas into the substrate processing zone is vertically spaced apart by a distance no longer than about 1,500 times the mean free path λ_g in the substrate processing zone.--

REMARKS

The application is believed to be in condition for allowance at the time of the next Official Action.

Claims 1-2 and 4-5 are pending. Claims 1 and 4 have been amended to differentiate the present invention in that the present invention is a reaction system between the uniformly supplied first and second gases.

There are no formal matters outstanding.

The Official Action rejected the pending claims under §103 as obvious over NEC Corp. (JP 11-168094) in view of KUTHI et al. 6,106,663.

The Official Action refers to Figure 5 of the NEC Corp. reference.

The cited NEC reference and the present invention are functional different devices. Accordingly, they have different structures. The NEC reference discloses a device where the substrate holder and injector are spaced in order to achieve the thermal radiation.

Any modification of the NEC device must take this into account. The presently proposed modifications suggested by the Official Action are not believed to be viable.

In contrast, the present invention relates to a plasma CVD apparatus which promotes forming a large area, homogenous and dense film taking into account gas mixing and necessary distance to the substrate for such mixing.

Claims 1 and 4 have been amended to more specifically recite this feature. There is no teaching of this feature in the applied references. Accordingly, allowance of the claims are solicited.

As to the previously pending recitations, in the first full paragraph of page 4 of the Official Action, it is acknowledged that the NEC Corp. reference does not disclose the recited plasma confining electrode with horizontal gas dispersion plates within the hollow structure (as per claim 1) or the gas introducing member with gas dispersion plates within the hollow structure (as per claim 4).

The Official Action has offered KUTHI et al. as disclosing horizontal gas dispersion plates 122 within a hollow gas introducing member electrode 114, making reference to patent column 1, lines 53-67 and Figure 1B.

The Official Action concludes that in light of Figure 1B and column 1, lines 53-67 teachings, it would have been obvious to modify the NEC apparatus to include the missing recited features. The stated reason for making this modification is KUTHI et al. teach such modifications would allow for more uniform flow of gas to the processing region.

However, see that claim 1 recites that "the plasma confining electrode has a hollow structure, accommodates horizontal gas dispersing plates within the hollow structure for uniformalizing a **second gas** in the plasma confining electrode, and has holes for introducing the **second gas** into the substrate processing zone..." and claim 4 recites that "the gas introducing member has a hollow structure, accommodates dispersing plates within the hollow structure for uniformalizing the **second gas** in the gas introducing member..." The obviousness rejection needs to be considered with respect to the whole inventive structure.

The disclosure of KUTHI et al. has no teachings as to a system operating with two gases. Rather, the disclosure of KUTHI et al. concerns a much simpler, single gas application and provides no insight into use in a two-gas system.

The disclosure of KUTHI et al. upon which the Official Action relies, concerns the prior art of Figures 1A-1E.

KUTHI et al. disclose by Figure 1A, a semiconductor processing system 100 including a chamber 102 that is used for processing semiconductor wafers through etching operations. The chamber 102 includes a chuck 104 configured to support a semiconductor wafer 106, and a plurality of quartz rings 108. Over a topmost quartz ring 108, sits a ceramic ring holder 110, which is configured to hold a top electrode 114. The top electrode 114 is configured to receive processing gases which will be distributed into the plasma region 112 during processing.

Figure 1A shows the top electrode coupled to a match box and diplexer 116a and an RF power source 118a. The chamber 102 is provided with outlets 120 which are configured to pump out excess gases from within the chamber during processing.

Figure 1B provides a more detailed view of the top electrode 114. The top electrode 114 is disclosed as comprising a number of gas buffer plates 122 with a plurality of holes defined throughout their surface region and configured to evenly distribute the processing gases throughout the top electrode 114.

From the above, it is clear that the hollow gas introducing member of KUTHI et al. is a simple, fully open volume with no passages for the first gas. There is no suggestion in the disclosure of KUTHI et al. to employ the plates in the more complex plasma CVD apparatus of the present invention which

requires passages for a first gas to pass through the hollow member without mixing with the second gas.

Without the teachings of the present application, it is believed that there is motivation to modify the NEC apparatus to that recited by the presently pending claims. Accordingly, the obviousness rejection is not believed to be viable.

Reconsideration and allowance of all the pending claims are therefore respectfully requested.

Attached hereto is a marked-up version showing the changes made to the claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

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"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

IN THE CLAIMS:

Claim 1 has been amended as follows:

--1. (twice amended) A plasma CVD apparatus comprising a substrate processing zone with a deposition substrate area disposed therein, a plasma generating zone for generating plasma of a first gas, and a plasma confining electrode for separating the substrate processing zone and the plasma generating zone and confining the first gas and having holes for passing the first gas containing neutral radicals from the first gas plasma such that the first gas is uniformly supplied to the substrate processing zone, wherein

the plasma confining electrode has a hollow structure, accommodates horizontal gas dispersing plates within the hollow structure for uniformalizing a second gas in the plasma confining electrode, and has holes for introducing the second gas into the substrate processing zone to form a desired film on a deposition substrate located on the deposition substrate area by gas phase chemical reaction of the first gas containing neutral radicals and the second gas with each other; and

the vertical distance between the [plasma confining electrode] holes for introducing the second gas into the substrate processing zone and the deposition substrate is no longer than 1,500 times the mean free path λ_g of a blend gas of

neutral radicals and the second gas in the substrate processing zone at the time of film formation.--

Claim 4 has been amended as follows:

--4. (twice amended) A plasma CVD apparatus comprising a substrate processing zone with a deposition substrate area disposed therein, a plasma generating zone for generating plasma of first gas, and a plasma confining electrode for separating the substrate processing zone and the plasma generating zone and confining the first gas and having holes for passing first gas containing neutral radicals from the first gas plasma, wherein

the plasma CVD apparatus further comprises a gas introducing member disposed between the plasma confining electrode member and the deposition substrate and having a plurality of holes, through which a second gas is introduced into the substrate processing zone to form a desired film on a deposition substrate by gas phase chemical reaction between the first gas containing neutral radicals and the second gas and a hole through which the first gas containing the neutral radicals is uniformly supplied to the substrate processing zone; and

the gas introducing member has a hollow structure, accommodates dispersing plates within the hollow structure for uniformalizing the second gas in the gas introducing member and the hole for introducing the second gas into the substrate processing zone is vertically spaced apart by a distance no

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longer than about 1,500 times the mean free path λ_g in the substrate processing zone.--